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SOLITAX sc

USER MANUAL

October 2005, Edition 3

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Section 1 Specifications

Specifications are subject to change without notice.

Measuring Technique	Infrared Duo scattered light technique for color-independent turbidity measurement Turbidity in accordance with DIN EN 27027 / TS equivalent DIN 38414
Measuring Range	t-line turbidity: 0.000–4000 FNU/NTU ts-line, inline turbidity: 0.001–4000 FNU/NTU; TSS content: 0.001–50 g/l hs-line, highline turbidity: 0.001–4000 FNU/NTU; TSS content: 0.001–150 g/l TSS
Reproducibility	Turbidity < 1%, Total Suspended Solids (TSS) < 3 %
Measuring Accuracy	Turbidity: Less than 1% of reading or ±0.001 NTU, whichever is greater Suspended Solids: Less than 5% of reading (depends on homogeneity of municipal activated sludge)
Response Time	1 s ≤ T90 ≤ 300 s (adjustable)
Calibration	Turbidity Formazin or StablCal® Standard (at 800 NTU). Requires a calibration kit. Suspended Solids Sample specific, based on gravimetric analysis with a correction factor procedure
Cable Length	10 m (33 ft) standard. Optional extension cables available in 25 ft, 50 ft, 100 ft Maximum total length: 100 m (328 ft).
Ambient Temperature	>0 to +40 °C (32–104 °F)
Pressure Range	≤ 6 bar (87 psi)
Flow Velocity	Max. 3 m/s (9.8 ft/s)
Materials	Optics carrier and sleeve: stainless steel 1.4571 or PVC black
	Wiper shaft: stainless steel 1.4104
	Wiper arm: stainless steel 1.4581
	Wiper rubber: silicone rubber (standard) Optional: Viton (LZX578)
	Windows and light guide: quartz glass (Suprasil)
	O-rings (optics carrier, wiper, windows): NBR (acrylonitrile butadiene rubber)
	Housing seals: NBR 70
	Sensor connecting cable (hard-wired): 1 cable pair AWG 22 / 12 V DC twisted, 1 cable pair AWG 24 / data twisted, common cable screen, Semoflex (PUR)
	Sensor connection plug (hard-wired): type M12 enclosure rating IP 67
Threaded cable fitting: stainless steel 1.4305 or PVC white	
Dimensions	Display unit: W x H x D 306 x 286 x 93 mm (12 x 11.3 x 3.7 in.)
	Immersion sensors (T-line, TS-Line and HS-line): D x L 60 x 200 mm (2 x 8 in.)
	Insertion sensor (Inline or Highline): D x L 60 x 315 mm (2 x 12.4 in.)
	Pipe installation fitting for insertion sensors: DN 65 / PN 16 DIN 2633; ≤5 bar; for pipes from DN 80 Distance sensor–wall (floor): TSS >10 cm, turbidity >50 cm
Weight	Display unit: approx. 3.5 kg (7.7 lb)
	Immersion sensors (T-line, TS-Line and HS-line): approx. 1.8 kg (4 lb) (t-line: approx. 0.6 kg (1 lb))
	Insertion sensor (Inline or Highline): approx. 2.4 kg (5.3 lb)
	Pipe installation fitting: approx. 2.7 kg (6 lb) (without probe) Pipe installation safety fitting: approx. 18 kg (40 lb) (without probe)
User Maintenance	1 h / month, typical
Certifications	CE, UL/CSA Safety Standards (cETLus)

Section 2 General Information

2.1 Safety Information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of Hazard Information

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol, when noted on the product, indicated the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.

2.2 Sensor Overview

Note: All sensors are also available without wipers for special applications.

t-line: 0.001–4000 FNU/NTU

High-resolution turbidity probe made of plastic for the outlets of sewage treatment plants and bodies of water.

ts-line: 0.001–4000 FNU/NTU; 0.001–50.0 g/L

High-precision turbidity and solids probe made of stainless steel or plastic for color-independent measurement of fine turbidities and sludges.

hs-line: 0.001–4000 FNU/NTU; 0.001–150.0 g/L

High-precision turbidity and solids probe made of stainless steel or plastic for color-independent measurement of highly concentrated sludges.

inline: 0.001–4000 FNU/NTU; 0.001–50.0 g/L

High-precision pipe installation probe for turbidity and solids made of stainless steel for color-independent measurement of fine turbidities and sludges.

highline: 0.001–4000 FNU/NTU; 0.001–150.0 g/L

High-precision pipe installation probe for turbidity and suspended solids made of stainless steel for color-independent measurement of highly concentrated sludges.

Figure 1 Solitax sc Sensors

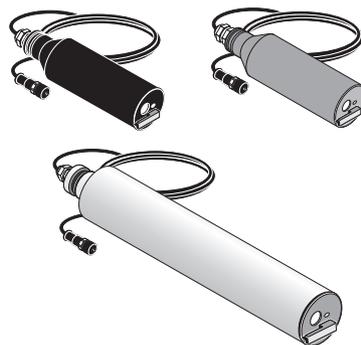
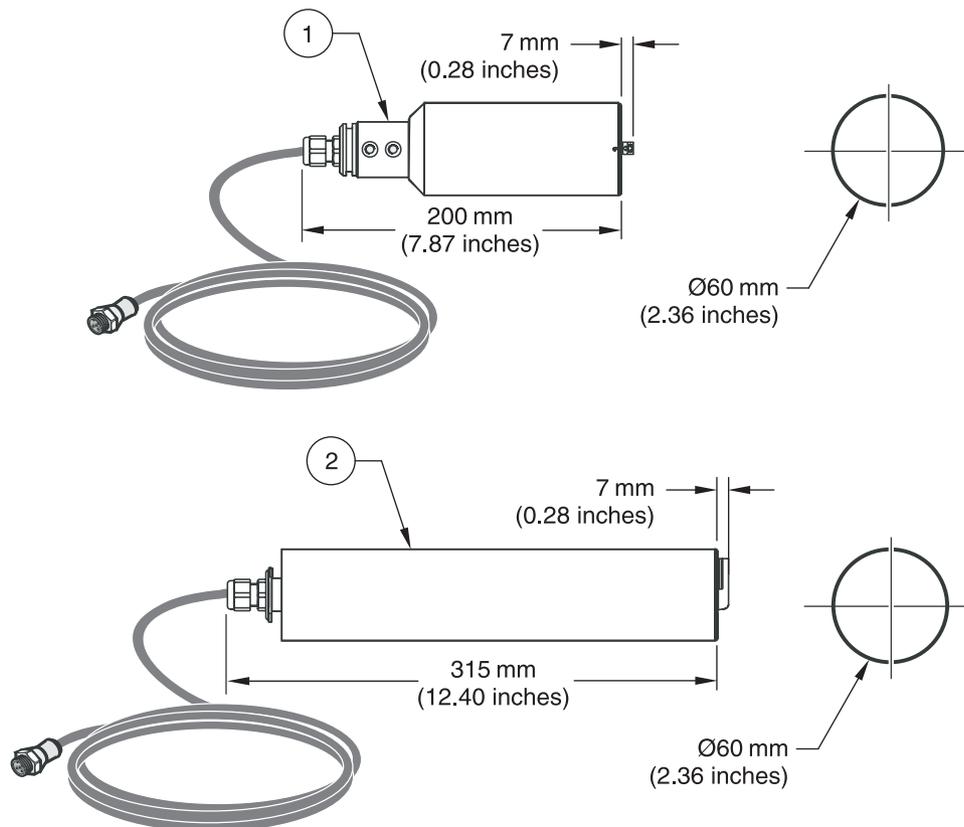


Figure 2 Sensor Dimensions



- | | |
|----|--|
| 1. | SOLITAX sc models t-line, ts-line, and hs-line for immersion in open tanks |
| 2. | SOLITAX sc models inline and highline sensors for insertion in pipes |

2.3 Measuring Principle

The measuring principle is based on a combined infrared absorption scattered light technique that measures the lowest turbidity values in accordance with DIN EN 27027 just as precisely and continuously as high sludge content.

The instrument is available as a turbidity-only analyzer, and as an analyzer that can measure both turbidity and suspended solids using an additional sensor photoreceptor. An LED (light-emitting diode) light source in the analyzer's sensor transmits a beam of infrared light into the sample stream at an angle of 45° to the sensor face. A pair of photoreceptors in the sensor face detect light scattered at 90° to the transmitted beam. In models that measure suspended solids, a back-scatter photoreceptor positioned at 140° to the transmitted beam detects light scattered in high-solids sample streams.

2.4 Handling

The sensor contains high-quality optical and electronic assemblies. Make sure the sensor is not subjected to any hard mechanical knocks. There are no customer-serviceable items inside the sensor and the display unit.

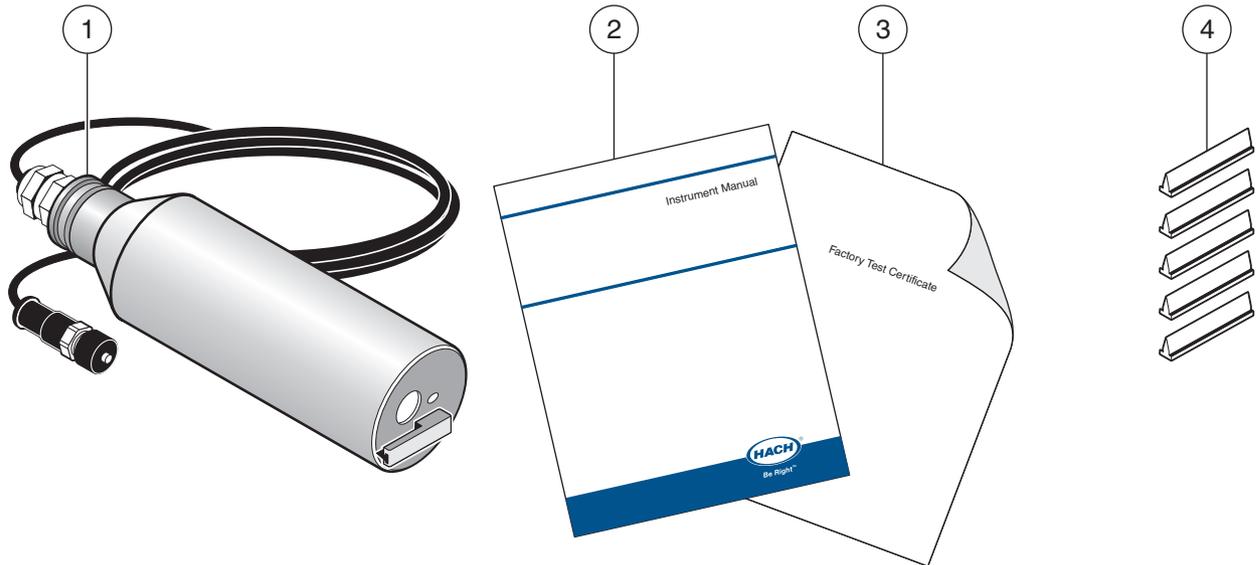
Section 3 Installation

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual.

3.1 Unpacking the Instrument

Figure 3 Items Supplied with Sensor1



1. SOLITAX sc Sensor	3. Factory Test Certificate
2. User Manual	4. Wiper Set (for 5 changes) LZX050

3.1.1 Function Check

After unpacking, both components should be checked for any transport damage and a short function check performed prior to installation.

To perform a function check, connect the sensor to the display unit and power the unit. Shortly after the unit is plugged in, the display is activated and the instrument switches to the measurement display. Measured values taken in air is meaningless.

If no messages appear in the lower part of the display, the function check is then complete.

3.2 Connecting/Wiring the Sensor to the sc100 Controller

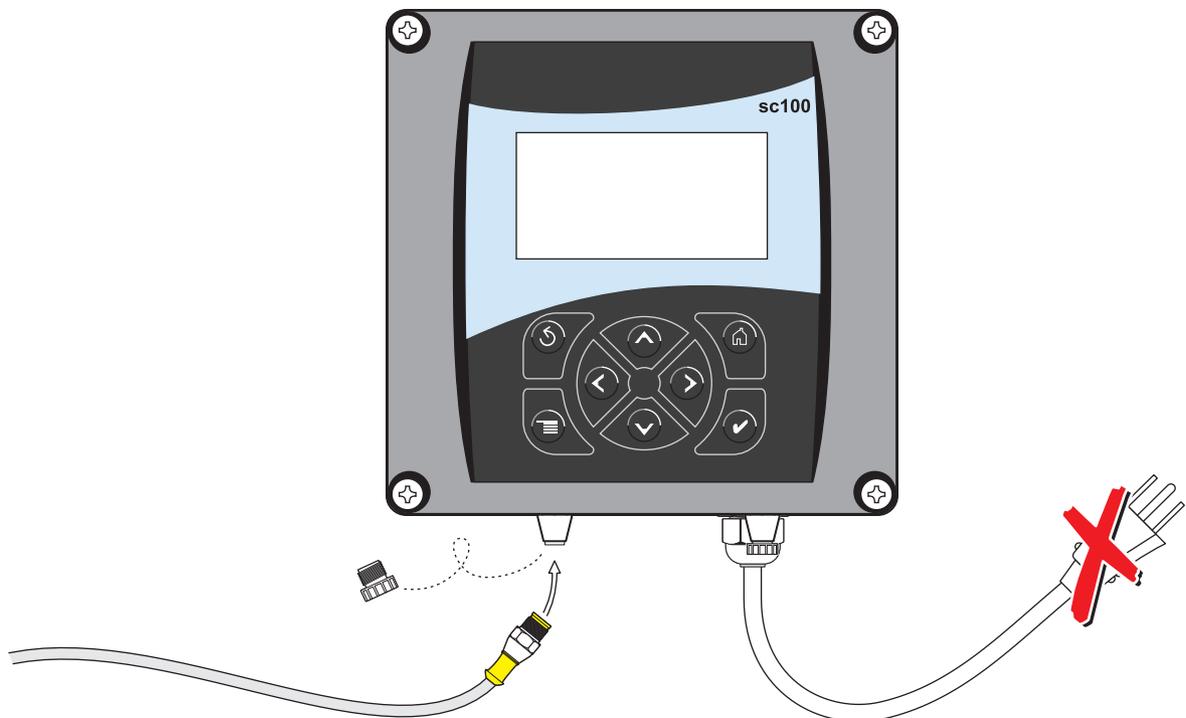
DANGER

Although the sc100 controller is certified for Class 1, Division 2 Hazardous Locations, it is only certified when installed with sensors listed in Control Drawings 5860078. The sc100 controller and this sensor are NOT suitable for use in Class 1, Division 2 Hazardous Locations.

3.2.1 Attaching a sc Sensor with a Quick-connect Fitting

The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller (Figure 4). Retain the connector cap to seal the connector opening in case the sensor must be removed. Optional extension cables may be purchased to extend the sensor cable length. If the total cable length exceeds 100 m (300 ft), a termination box must be installed.

Figure 4 Attaching the Sensor Using the Quick-connect Fitting



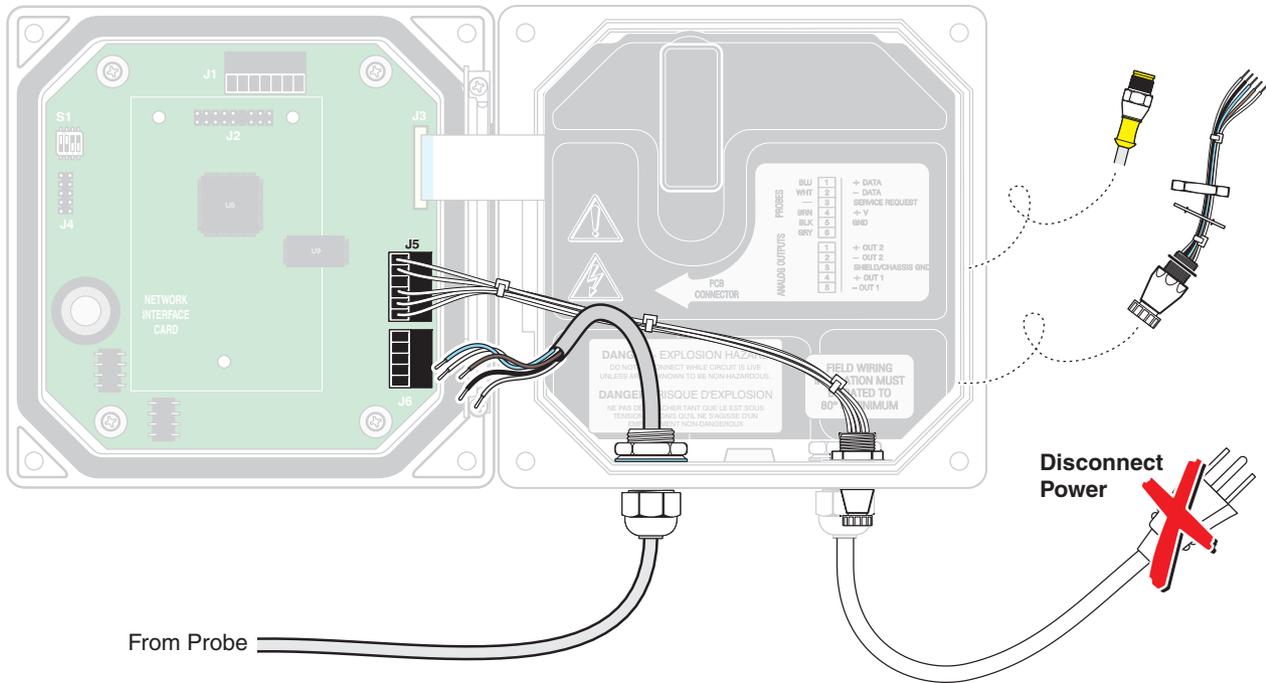
3.2.2 Hard-wiring a sc Sensor to the Controller

1. Disconnect power to the controller.
2. Open the controller cover.
3. Disconnect and remove the existing wires between the quick-connect and terminal strip J5, see [Figure 5 on page 14](#).
4. Remove the quick-connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.
5. Cut the connector from the sensor cable.
6. Strip the insulation on the cable back 1-inch. Strip ¼-inch of each individual wire end.
7. Pass the cable through conduit and a conduit hub or a strain relief fitting (Cat. No. 16664) and an available access hole in the controller enclosure. Tighten the fitting. Use of strain relief fitting other than Cat. No. 16664 may result in a hazard. Use only the recommended strain relief fitting.
8. Reinstall the plug on the sensor access opening to maintain the environmental rating.
9. Wire as shown in [Table 1](#) and [Figure 5](#).
10. Close and secure the cover.

Table 1 Wiring the Sensor at Terminal Block J5

Terminal Number	Terminal Designation	Wire Color
1	Data (+)	Blue
2	Data (-)	White
3	Service Request	No Connection
4	+12 VDC	Brown
5	Circuit Common	Black
6	Shield	Shield (grey wire in existing quick-disconnect fitting)

Figure 5 Hard-wiring the Sensor



3.3 Connecting the Sensor to the sc1000

3.3.1 Connecting the Sensor using the Quick-connect Fittings

1. Unscrew the connector cap from the controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.
2. Push the connector into the socket.
3. Hand-tighten the union nut.

Note: Do not use the middle connection for the sensors as this is reserved for the display module.

3.4 Sensor Installation

3.4.1 Installation Overview

[Figure 6 on page 16](#) and [Figure 7 on page 17](#) illustrates the installation overview for Solitax sc Models t-line, ts-line, and hs-line for immersion in open tanks (Fixed Point Installation Kit, Cat. No. 57344-00). Refer to [Figure 8 on page 18](#) for a description of the Sensor Bracket Components.

The maximum distance from the mounting surface to the sensor without the use of an extension tube is 1.5 m (4.9 ft) as shown in [Figure 7 on page 17](#). When that distance exceeds 1.5 m (4.9 ft), one of the following extension tubes is required and can be ordered separately:

- Extension Tube, 35 cm (1.15 ft), Cat. No. BRO068
- Extension tube 1.0 m (3.28 ft), Cat. No. BRO061
- Extension tube 1.8 m (5.90 ft), Cat. No. BRO062

To ensure a suitable measuring position, install the probe to the following conditions:

- The probe optical window must have a ground clearance of at least 30 cm (11.8 in.).
- Install the probe with the optical window facing (downstream) in the direction of the flow to minimize the risk of fouling.
- Avoid installation sites where air bubbles are inconsistent. If this not possible, try moving the probe slightly or adjusting its alignment to minimize the bubble effect.
- Protect the probe against the oncoming flow of large objects, such as branches or ice and against flow surges.
- Avoid installing the probe with the optical window facing into direct light or facing a highly-reflective surface.

Figure 6 Sensor Installation Overview

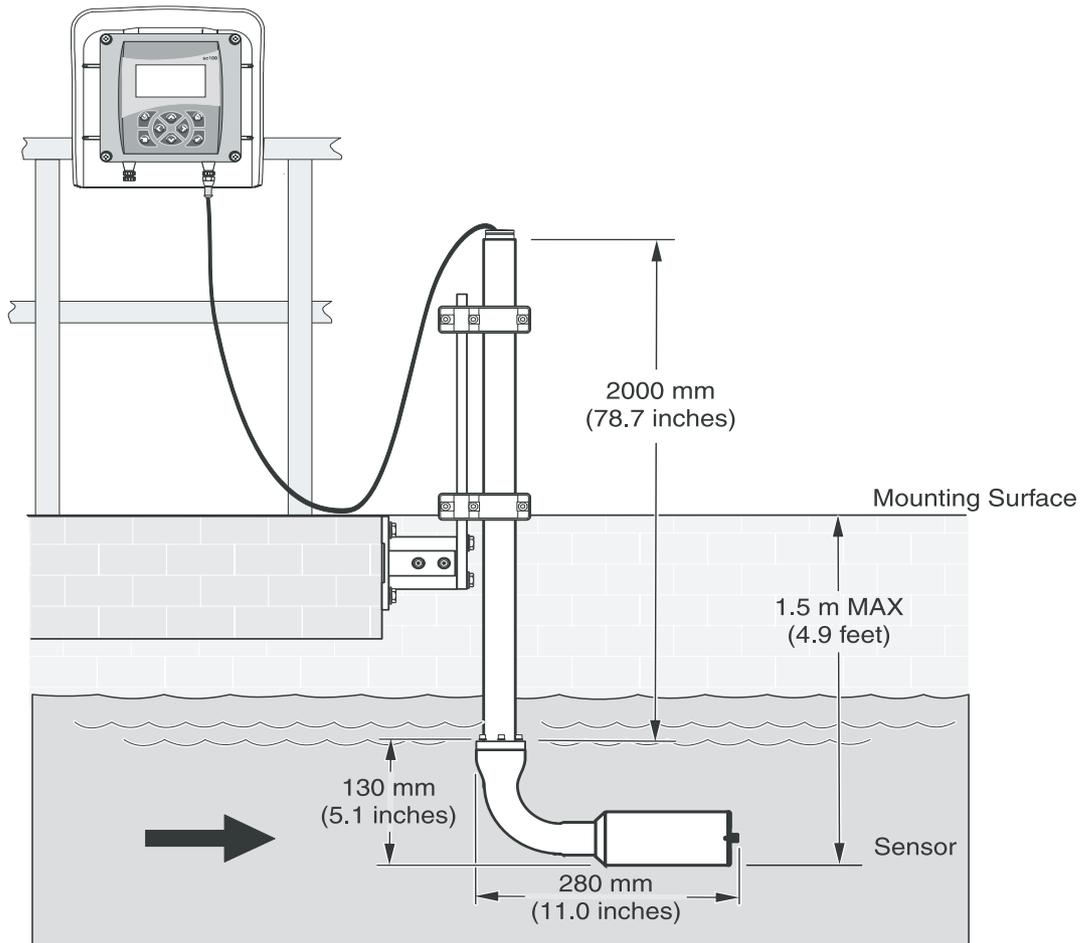
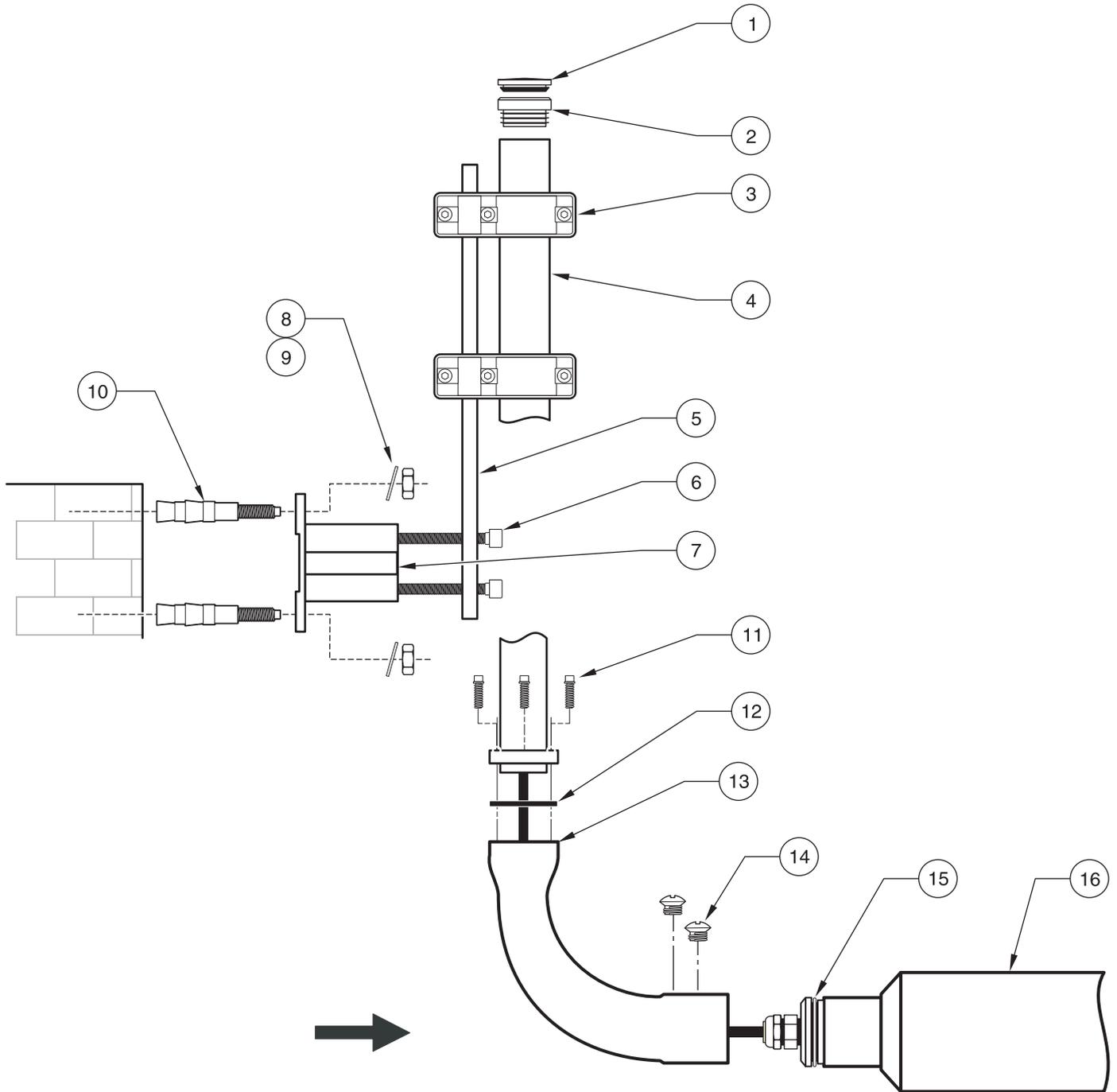
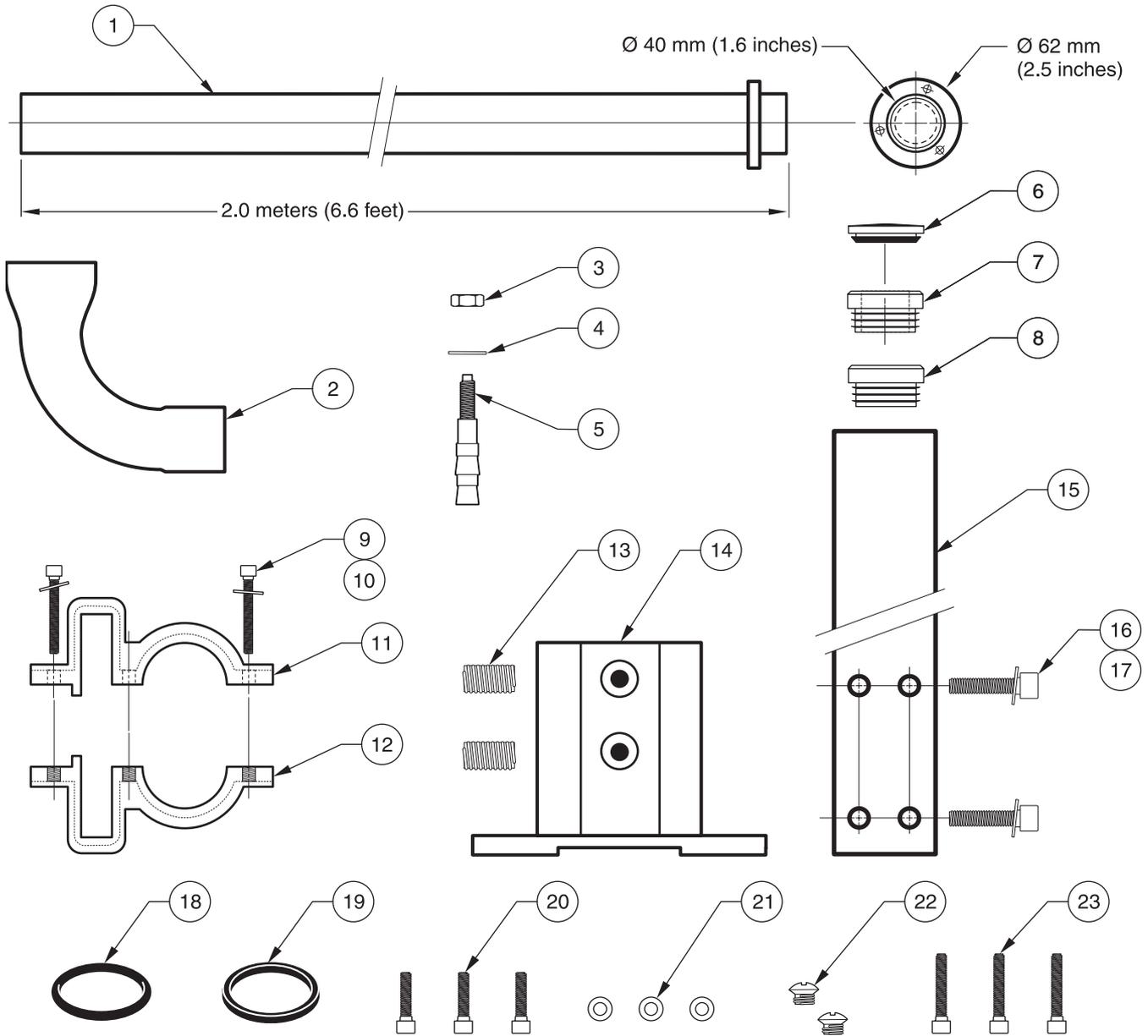


Figure 7 Fixed Point Installation Kit (57344-00) for Solitax models t-line, ts-line, and hs-line sensors



1. Sealing Plug	9. Flat Washer
2. Plug	10. Concrete Anchor
3. Retaining Clamp (2)	11. Bolt M3 x 10 (3)
4. Mounting Pipe (2.0 meters)	12. Flat seal
5. Fastening Lug	13. Adapter 90°
6. Bolt, M8 x 40 (4)	14. Countersunk head bolt M6 x 8 (2)
7. Base	15. O-ring EPDM
8. Hex Nut	16. Probe

Figure 8 Sensor Bracket Components



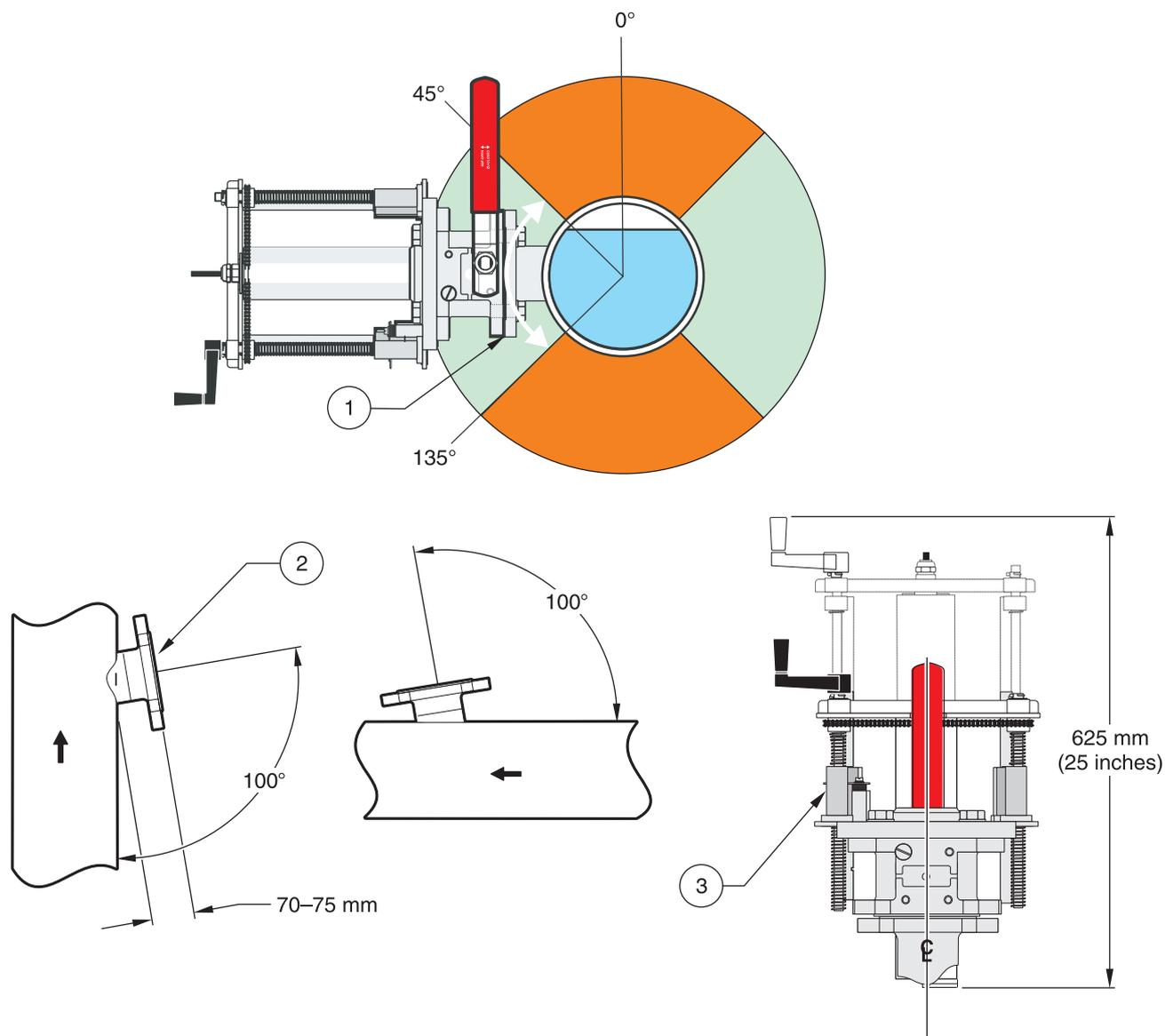
1. Mounting pipe 2.0 m	13. Set screws (2)
2. 90° adapter	14. Base
3. Hex Head Cap screws (4)	15. Fastening Lug
4. Flat Washers (4)	16. Bolt M8 x 40 (4)
5. Concrete Anchors (4)	17. Sealing plug (rubber)
6. Sealing Plug (LZX417)	18. O-ring, EPDM (LZX417)
7. Open Grommet	19. Flat Seal (LZX417)
8. Closed Grommet (LZX417)	20. Bolt M3 x 10 (3) (LZX417)
9. Socket Head Cap Screws (6)	21. Flat washers (3) (LZX417)
10. Flat Washers (6)	22. Countersunk head bolt M6 x 8 (2) (LZX417)
11. Bracket with thru holes (2)	23. Three extra socket head cap screws (M3 X 16) are included with the kit. These screws are not used with the Solitax.
12. Bracket with tapped holes (2)	

3.5 Pipe Installation

The Insertion Mounting Kit (Cat. No. 57384-00) for inline and highline insertion sensors includes a Carbon Steel flange (LZX703) and ball valve and extraction system (LZX337).

Note: It is recommended to coat the Carbon Steel flange with a protective coating to prohibit rust.

Figure 9 Installation Preparation

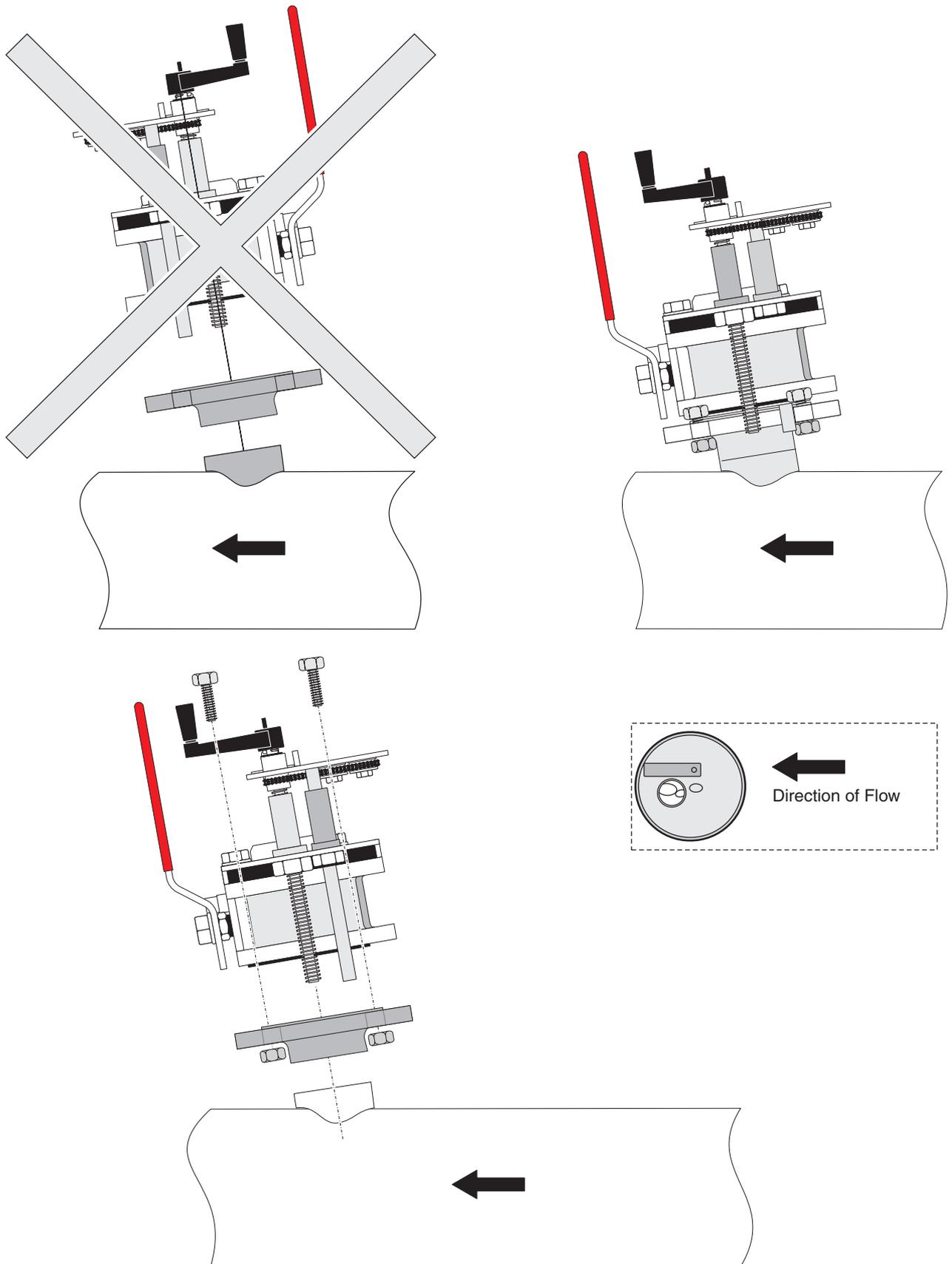


1.	Recommended installation angle 45°-135°
2.	Welded flange: Carbon Steel LZX703
3.	Pipe installation LZX 337

3.5.1 Pipe Installation Placement Guidelines

- Install the sensor in an up-flow pipe section for best results. Do not mount the sensor in a down-flow pipe section.
- Mounting in a horizontal pipe section is acceptable if the sensor is fully immersed at all times. Usually, mounting 90 degrees from the top of the pipe guarantees full immersion. Do not mount on the top or bottom of a horizontal pipe section.
- Install the sensor in a pipe that is equal to or greater than 4 inches in diameter.
- Install the sensor at least 1.5 m (5 ft.) or three times the pipe diameter (whichever is greater) downstream of pumps, valves, or pipe elbows.
- Install the sensor on the discharge side of a pump, if possible, with a dilution or flush valve installed on the suction side of the pump.
- If the sensor is to be used to measure sludge with significant amounts of debris, install it after a sludge grinding pump or after a pump with a grinding/comminuting unit in front of it.
- Install the sensor within 7.8 M of the controller with the standard probe cable. Optional cable extensions can be added for a maximum combined distance of 100 meters.
- If the flange cannot be welded to the pipe due to incompatibility of materials between the stud and the pipe, it is recommended that a stainless steel pipe section be fabricated. Weld the flange onto the stainless steel pipe section and attach the stainless steel section as a segment of the process pipe.

Figure 10 Proper Positioning for Insertion into Pipe

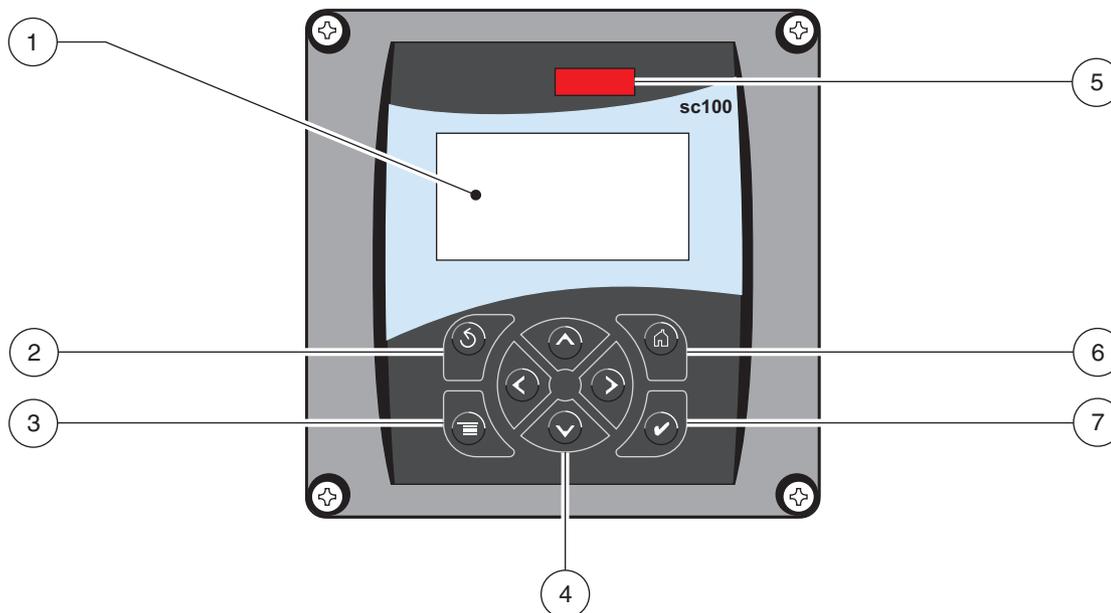


Section 4 User Interface and Navigation

4.1 Using the sc100 Controller

The front of the controller is shown in Figure 11. The keypad consists of the eight keys described in Table 2.

Figure 11 Front of the Controller



1. Instrument display	5. IrDA window
2. BACK key	6. HOME key
3. MENU key	7. ENTER key
4. RIGHT, LEFT, UP, and DOWN keys	

Table 2 Controller Key Functions/Features

Number	Key	Function
2		Moves back one level in the menu structure.
3		Moves to the main menu from other menus. This key is not active in menus where a selection or other input must be made.
4		Navigates through the menus, changes settings, and increments and decrements digits.
5		Moves to the Main Measurement screen from any other screen. This key is not active in menus where a selection or other input must be made.
6		Accepts an input value, updates, or accepts displayed menu options.

4.1.1 sc100 Display Features

When a sensor is connected and the controller is in measurement mode, the controller display will show the current reading. On startup, when a sensor error has occurred and when a sensor is being calibrated, the display will flash.

An active system warning will cause the warning icon (a triangle with an exclamation point inside) to be displayed on the right side of the display.

4.1.2 Important Key Presses



1. Status line (indicates sensor names and the status of the relay contacts)	3. Current output 1 or 2	5. Area for the warning icon
2. Main measured value	4. Parameter	6. Unit of measure

- Press the **HOME** key then the **RIGHT** or **LEFT** key to display two readings when two sensors are connected. Continue to press the **RIGHT** or **LEFT** key to toggle through the available display options.
- Press the **UP** and **DOWN** keys to toggle the status bar at the bottom of the measurement display to display the secondary measurement (temperature) and output information.
- When in Menu mode, an arrow may appear on the right side of the display to indicate that more menus are available. Press the **UP** or **DOWN** key (corresponding to the arrow direction) to display additional menus.

4.2 Using the sc1000 Controller

The sc1000 is a touch screen application. Use your finger to touch keys and menu commands. In normal operation the touch screen displays the measured values for the sensors selected.

4.2.1 Display Features

4.2.1.1 Using the Pop-up Toolbar

The pop-up toolbar provides access to the controller and sensor settings. The toolbar is normally hidden from view. To view the toolbar, touch the bottom-left of the screen.

Figure 12 Pop-up Toolbar Functions



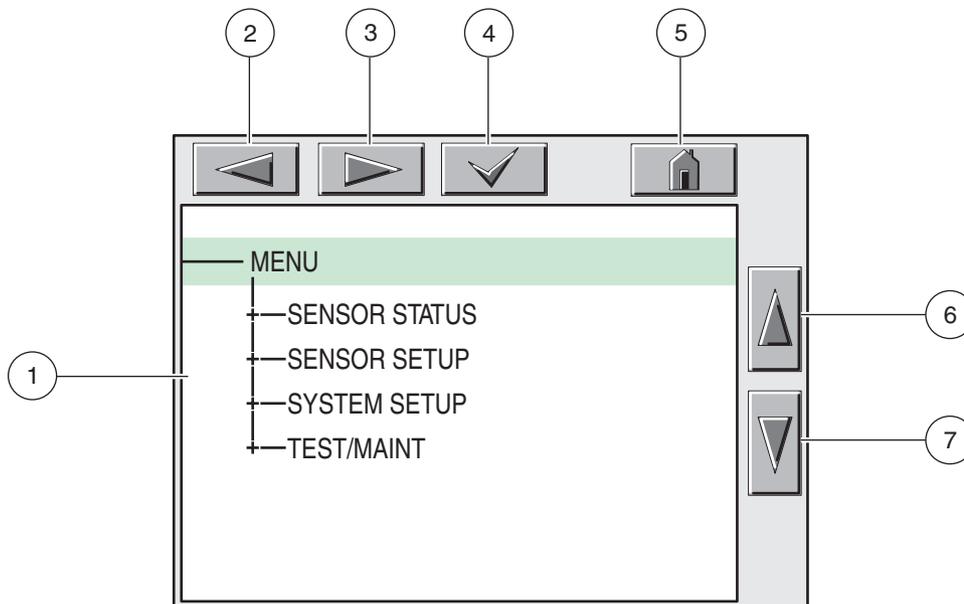
	MAIN MENU —displays the Main Menu Structure
	UP Arrow —scrolls up to the previous displayed value.
	Displays one value.
	Displays two values at the same time.
	Displays four values at the same time.
	LIST —displays the list of connected devices and sensors.
	DOWN Arrow —scrolls down to the next displayed value.

4.2.1.2 Using the Menu Windows

If the Menu button (from the pop-up toolbar) is selected, the Main Menu screen is opened. The Main Menu screen allows the user to view the sensor status, configure the sensor setup, system setup, and perform diagnostics.

The menu structure may vary depending on the configuration of the system.

Figure 13 Main Menu



1.	Display Area
2.	BACK
3.	FORWARD
4.	ENTER —confirms the entry or selection.
5.	HOME —changes to the display of measured values. The pop-up toolbar cannot open from the menu window. To view the Main Menu from this display, touch the Home button and then the bottom of the screen.
6.	UP —scrolls up
7.	DOWN —scrolls down

4.2.1.3 Navigating the Menu Windows

To view a menu item, touch the menu item or use the **UP** and **DOWN** keys to highlight the item. The menu item remains highlighted for approximately 4 seconds after it is selected. To view the highlighted command, select the area to the left of the menu item or select the **ENTER** button.

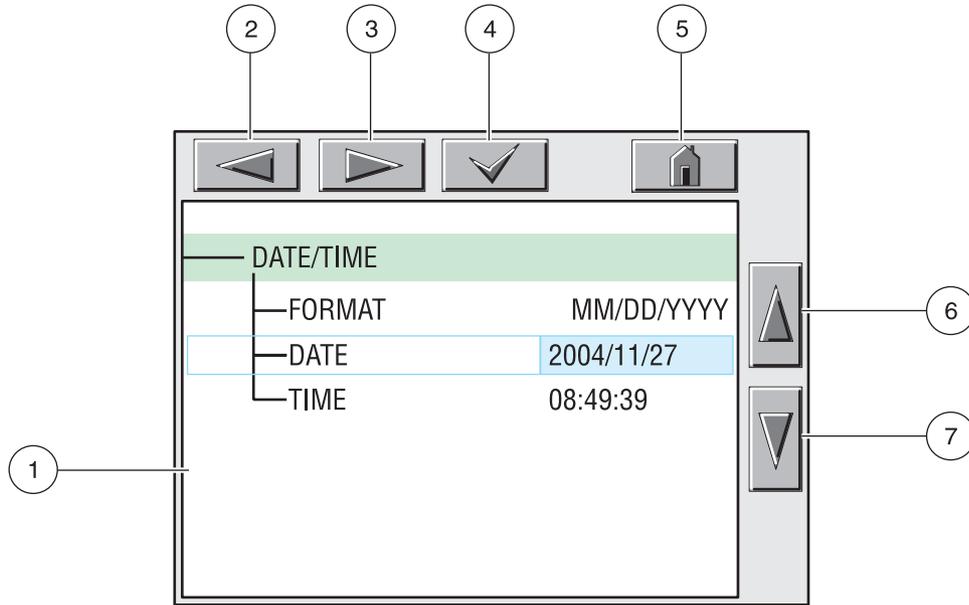
A “+” next to a menu command indicates there is a submenu. Touch the “+” to view the submenu. An “i” next to a menu command indicates it is information only.

If a menu item is editable, highlight the item and touch the far-left part of the menu item until it is highlighted and press **ENTER** or double-tap the highlighted item. A keypad will be displayed to change an entry (Figure 15 on page 27) or a list box will be displayed (Figure 16 on page 28).

Messages are displayed in the message window (Figure 17 on page 28).

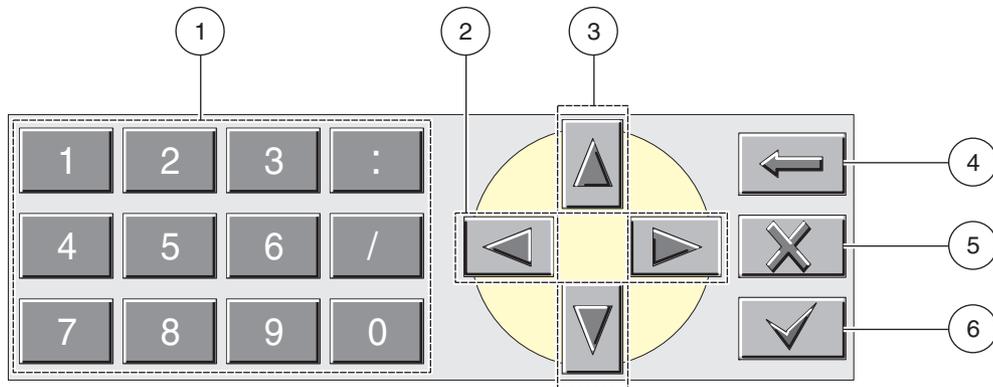
If an entry is incorrect, repeat the entry with the correct values. If the entry is outside the working range, a correction to the entry is made automatically.

Figure 14 Changing a Menu Item



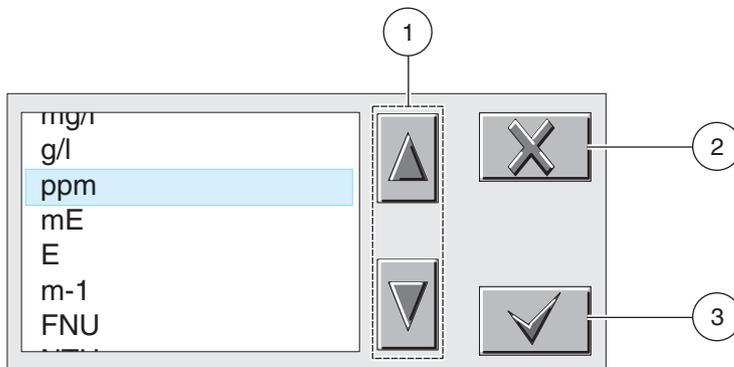
1. Display Area	5. HOME—changes to the display of measured values.
2. BACK	6. UP—scrolls up
3. FORWARD	7. DOWN—scrolls down
4. ENTER—confirms the entry or selection.	

Figure 15 Keypad



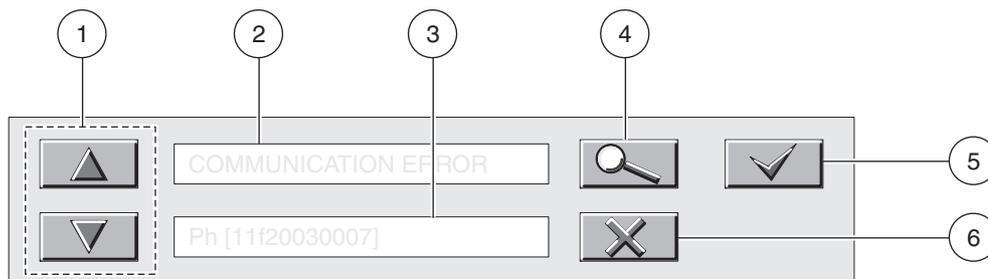
1. Enters numbers or the character as shown on the button.
2. Moves the cursor one position to the left or to the right.
3. Increase/Decrease a number or letter at the cursor position. Keep the button pressed to change the numbers/characters continuously.
4. Deletes the character to the left of the cursor.
5. CANCEL—cancels the entry.
6. ENTER—confirms the entry or selection.

Figure 16 List Box



- | |
|--|
| 1. Scrolls up or down |
| 2. CANCEL —cancels and entry. |
| 3. ENTER —confirms a selection. |

Figure 17 Message window



- | |
|--|
| 1. Scrolls up or down. |
| 2. Displays the messages or warnings. |
| 3. Displays details on the selected entry. |
| 4. This button changes back to the previous display. |
| 5. ENTER —confirms an entry. |
| 6. CANCEL —cancels an entry. |

Section 5 Operations

5.1 Sensor Setup

When a sensor is initially installed, the serial number of the sensor will be displayed as the sensor name. To change the sensor name refer to the following instructions:

1. Select Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Highlight the appropriate sensor if more than one sensor is attached and confirm.
4. Select CONFIGURE and confirm.
5. Select EDIT NAME and edit the name. Confirm or cancel to return to the Sensor Setup menu.

5.2 Sensor Data Logging

The sc100 controller provides three data logs (one for each sensor and one for calculated values) and three event logs (one for each sensor and one for the controller). The data logs store the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, and warning conditions. The data logs are stored in a packed binary format and the event logs are stored in a CSV format. The logs can be downloaded through the digital network port or the IrDA port.

5.3 Sensor Diagnostics Menu

SELECT SENSOR (if more than one sensor is attached)

STATUS	
ERROR LIST	See section 7.1 on page 37 .
WARNING LIST	See section 7.2 on page 37 ..

5.4 Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)

WIPE	
	Initiates a wiping action on the sensor window.
CALIBRATE	
SET OUTMODE	Select the behavior of the outputs during calibration for zero point setting (Hold, Active, Transfer, Selection). Hold maintains the last reading prior to going into the menu. Active transmits the current level readings, corrected with previous calibration data until new data is entered. Set Transfer transmits the value designated during the system setup
SENSOR MEASURE	Displays the current, uncorrected measured value.
CONFIGURE	Select the calibration type and follow the calibration steps for 2 point, 3 point, 4 point, and 5 point calibration.
FACTOR/2 POINTS/3 POINTS/4 POINTS/5 POINTS	Display depends on the selection in configuration.
SET CAL DEFAULT	Return the instrument to the default calibration settings.

5.4 Sensor Setup Menu (continued)

CONFIGURE	
EDIT NAME	Enter up to a 10-digit name in any combination of symbols and alpha or numeric characters.
SET PARAMETER	This setting configures the Solitax to measure turbidity or suspended solids. The Solitax cannot simultaneously measure both. Choose "TRB" for turbidity measurements, or "TS" for suspended solids measurement. This selection determines which units may be selected in the "Meas Units" menu.
MEAS UNITS	Choose from the displayed units. TRB (FNU, EBC, TE/F, NTU); TS (mg/L, g/L, ppm, %) Default: FNU If TRB was selected in set parameter, select "NTU" (commonly used in the U.S.), FNU, EBC, or TE/F. If TS was selected, choose mg/L, g/L, ppm, or %. Press enter to choose the selection. If the units selected result in a reading that exceeds 4 digits, the display will only show dashes. For example, if mg/L were selected, and the measurement was 10,500 mg/L, the display will show dashes until the reading drops to 9999 or lower.
CLEAN INTERVAL	Select the cleaning interval (1, 5, 15 or 30 minutes; 1, 4, or 12 hours; 1, 3, 7 days) Default: 12 hours This is the interval between wiper cleaning of the sensor window. It is recommended to start with a setting of 30 minutes. This time may be adjusted according to the application. If readings continue to be accurate, try a longer interval. If not, shorten the interval.
RESPONSE TIME	This is a damping function. While the Solitax takes readings continually, it will average them together over the period of the response time. Once the response time has elapsed, the displayed reading, 4-20 outputs, and alarm status are updated. (0 to 300 seconds) Default: 3 seconds
LOGGER INTERVAL	This is the datalog interval, with options from 1-15 minutes. Values logged are the average of the all readings during the previous logging interval. The controller will hold approximately 360 days of readings for one sensor at 15 minute intervals, or 24 days at 1 minute intervals (and proportional in between). Default: 10 minutes
SET DEFAULTS	Resets all user-editable options to the factory-defaults.
TEST/MAIN	
PROBE INFO	Displays the sensor type, entered name of the sensor (Default: sensor serial number), the sensor serial number, the software version number, and the sensor driver version number.
PROFILE	Select Profile Counter to display the number of wipes made (from 20000 backwards). Select Reset Config to manually reset the profile counter.
COUNTER	Shows the number of hours or cycles left for operating hours, test/maint, gasket, and the motor.
TEST/MAIN	WIPE—Initiates the wiping action of the wiper.
	SIGNALS—displays the signal outputs for the device.
	OUTPUT MODE—Select the behavior of the instrument outputs (Hold, Active, Transfer, Selection)
	DEFAULT SETUP—Resets all user-editable options to the factory defaults.

5.5 Calibration

There are two calibration techniques; depending on whether turbidity or suspended solid is required (refer to [section 5.5.2](#) or [section 5.5.3 on page 32](#)). Before calibration, determine the behavior of the 4–20 outputs and alarm relays while the user is in the CALIBRATE menu (refer to [section 5.5.1](#)).

5.5.1 Setting the Outmode

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and press confirm.
4. Select SET OUTMODE. Select the available Out Mode (Active, Hold, Transfer) and confirm.

5.5.2 Calibration for Turbidity

Turbidity calibration requires the use of 800 NTU Turbidity Standard Solutions and Calibration Kit (Cat. No. 57330-00). A zero-point calibration using deionized water is also recommended.

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and press confirm.
4. Select SENSOR MEASURE and confirm.
5. Place the sensor in the calibration cylinder with deionized water, mounting it with the supplied clamp. The tip of the probe should be approximately 1-inch below the surface of the water. Record the reading from the sensor measure display.
6. Select OFFSET. Multiply the reading obtained in step 5 and enter the value.
7. Select SENSOR MEASURE.
8. Rinse the outside of the StablCal® 800 NTU standard with water to remove any dust or debris adhering to the surface of the bottle. Gently invert both StablCal standard bottles a minimum of 50 times. Remove the lid and seal from each bottle. Slowly (to avoid creating bubbles) pour the contents of the bottles into the calibration cylinder. Immediately place the tip of the probe into the positioning bracket in the calibration cylinder. The tip of the probe should be approximately 1-inch below the surface standard. Allow the reading to become stable on the SENSOR MEASURE screen. Record the value (measured value). Calculate the factor. Refer to [section 5.5.2.1](#).
9. Select FACTOR to display the corrected measurement.

5.5.2.1 Calculating the Factor

$$\text{New Factor} = \frac{800 \text{ NTU Standard}}{\text{measured value}}$$

For example, if a sample measures 750 NTU using the sensor and the standard is 800 NTU, the new factor would be calculated as follows:

$$\text{New Factor} = \frac{800}{750} = 1.07$$

5.5.3 Calibration for Suspended Solids

Suspended solids calibration requires calibration to the actual sample. This optimizes the compensation for the particle size and shape typical at a measuring site. It is best performed by mounting the sensor as usual for normal measurement, and then grab samples collected and evaluated by laboratory methods. While a single point calibration is usually sufficient to provide accuracy, the SOLITAX does offer the ability to calibrate with up to 5 calibration points.

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and press confirm.
4. Select CONFIGURE and confirm.
5. Select the number of points desired for calibration (the unit will linearly interpolate values between calibration points). Select Factor for a single point calibration.
6. Mount the sensor as is during normal operation. Alternatively, place the sensor in the calibration cylinder (or a container with dark, non-reflective walls) 2 inches of clearance from the probe face with the probe face submerged by 1 inch or more.
7. Select SENSOR MEASURE and record the reading.
8. Immediately take a grab sample. Determine the total suspended solids using a gravimetric method such as Method 2540 D in *Standards Methods for the Examination of Water and Wastewater*.
9. Calculate the new factor. Refer to [section 5.5.3.1](#) for single point (Factor) calibration. Refer [section 5.5.3.2 on page 33](#) for multiple point calibrations.
10. Select FACTOR and press confirm. The corrected measurement should be displayed.

5.5.3.1 For Single Point (Factor) Calibration

Calculate the new factor:

$$\text{New Factor} = \frac{\text{Determined gravimetric value}}{\text{measured value}}$$

For example, if a sample measures 23 mg/L using the SS sensor and the gravimetric value was 20 mg/L, the new factor would be calculated as follows:

$$\text{New Factor} = \frac{20}{23} = 0.86 \text{ mg/L}$$

5.5.3.2 Multi-point Calibration

1. Repeat steps 6–8 in [section 5.5.3 on page 32](#) at different times to obtain different measurements.
2. From the CONFIGURE menu, select the appropriate calibration point menu.
3. Enter the pairs of values for each reading, the target value being the laboratory determined value, and the actual value being the reading that the SOLITAX produced in step 5. The pairs should be entered in order from lowest values to highest.

Section 6 Maintenance

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual.

Proper maintenance of the measuring windows in the sensor is critical for accurate measurements. The measuring windows should be checked monthly for soiling and the wiper checked for wear.

Important Note: *The seals must be replaced every 2 years by the Service Department. If the seals are not changed regularly, water may enter the probe head and seriously damage the instrument.*

6.1 Maintenance Schedule

Maintenance Task	Duration
Visual inspection	monthly
Check calibration	monthly (depending on the ambient conditions)
Inspection	six months (counter)
Seal change	every 2 years (counter)
Change wiper and reset counter	as per counter (20000 cycles)

6.2 Cleaning the Sensor Measuring Windows

CAUTION

Always wear safety glasses and gloves when handling hydrochloric acid.

The measuring windows are made of quartz glass. If necessary, they can be cleaned with a cleaning agent and a cloth.

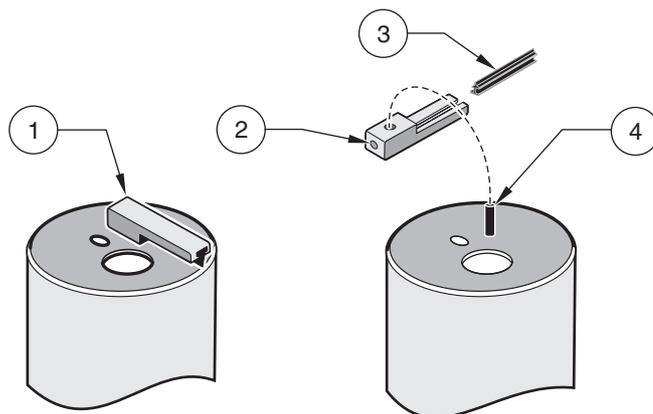
For very stubborn deposits a 5 % solution of hydrochloric acid is recommended.

6.3 Replacing the Wiper

The life of the wiper is dependent on the number of cleaning actions performed and the type of deposits to be removed. The life of the wiper varies. The wipers supplied with the instrument should last for approximately one year.

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select TEST/MAINT and press confirm.
4. Select PROFILE and confirm. Change the wiper, see [section 6.3 on page 36](#).
5. Select RESET CONFIG and confirm.
6. Select MAN. RESET ARE YOU SURE? and confirm.

Figure 18 Wiper Replacement



1. Wiper arm	3. Wiper
2. M4 hex socket head bolt	4. Wiper axle

Section 7 Troubleshooting

7.1 Error Codes

In the case of an error, the indication of the measured value flashes on the display and all the contacts and current outputs allocated to this sensor are placed on hold. The following conditions will result in flashing measured values:

- Data transmission between controller and sensor interrupted

On the Main menu open the SENSOR DIAG menu using **ENTER** and determine the cause of the fault.

Table 3 Error Messages

Error Displayed	Cause	Solution
POS. UNKNOWN	Wiper position unknown	Open the TEST/MAINT menu and trigger the "WIPE" function, if the problem persists contact the manufacturer's customer service
LED FAULTY	Faulty LED	Contact customer service
MOIST	Moisture value > 10	Remove the sensor immediately and store in a dry place, contact customer service
CAL. DATA	Factory calibration data lost	Contact customer service

7.2 Warnings

A warning results in a flashing warning icon on the right of the display, all menus, contacts and outputs remain unaffected and continue to work normally. On the Main menu open the SENSOR DIAG menu using **ENTER** and determine the cause of the warning.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning.

Table 4 Warnings

Warning Displayed	Cause	Solution
WARNING	Cause	Action
REPLACE WIPER	Counter elapsed	Replace wiper, reset counter
TEST/MAINT	Counter elapsed	Contact customer service
GASKET	Counter elapsed	Contact customer service

Section 8 Replacement Parts and Accessories

8.1 Immersion Sensors¹

Description	Catalog Number
Turbidity, t-line sc, PVC with wiper (0.001 to 4000 NTU)	LXV423.99.10000
Turbidity, t-line sc, PVC without wiper (0.001 to 4000 NTU)	LXV423.99.12000
Turbidity and Suspended Solids, ts-line sc, PVC with wiper (0.001 to 4000 NTU, 0.001 to 50 g/L)	LXV423.99.10100
Turbidity and Suspended Solids, ts-line sc, PVC without wiper (0.001 to 4000 NTU, 0.001 to 50 g/L)	LXV423.99.12100
Turbidity and Suspended Solids, ts-line sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 to 50 g/L)	LXV423.99.00100
Turbidity and Suspended Solids, ts-line sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 to 50 g/L)	LXV423.99.02100
Turbidity and Suspended Solids, hs-line sc, PVC with wiper (0.001 to 4000 NTU, 0.001 to 150 g/L)	LXV423.99.10200
Turbidity and Suspended Solids, hs-line sc, PVC without wiper (0.001 to 4000 NTU, 0.001 to 150 g/L)	LXV423.99.12200
Turbidity and Suspended Solids, hs-line sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 to 150 g/L)	LXV423.99.00200
Turbidity and Suspended Solids, hs-line sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 to 150 g/L)	LXV423.99.02200

¹ All sensors come with the sensor, replacement wipers, and manual.

8.2 Insertion Sensors¹

Description	Catalog Number
Turbidity and Suspended Solids, inline sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 to 50 g/L)	LXV424.99.00100
Turbidity and Suspended Solids, inline sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 to 50 g/L)	LXV424.99.02100
Turbidity and Suspended Solids, highline sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 to 150 g/L)	LXV424.99.00200
Turbidity and Suspended Solids, highline sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 to 150 g/L)	LXV424.99.02200

¹ All sensors come with the sensor, replacement wipers, and manual.

8.3 Replacement Parts

Description	Catalog Number
Adapter, Sensor 90° elbow	AHA034
Ball valve for insertion probes without adapting flange	LZX337
Calibration kit, includes calibration cylinder, two 500-mL 800 NTU StablCal® and a sensor bracket	57330-00
Conduit strain relief	16664
Extension cable, 7.6 m (25 ft)	57960-00
Extension cable, 15.2 m (50 ft)	57961-00
Extension cable, 30.5 m (100 ft)	57962-00
Extension tube, 1.8 m	BRO062
Extension tube, 1.0 m	BRO061
Extension pipe, 0.35 m	BRO068
Handrail mounting kit (for sensor to be used with either AHA033NPT or AHA034NPT) includes 1.5 inch diameter by 7.5 ft long CPVC pipe and swivel/pivot/pipe clamp assembly	MH236B00
Insertion mounting kit for inline and highline insertion sensors (ball valve and extraction system)	57384-00
Installation kit, fixed-point (for t-line, ts-line, and hs-line immersion sensors)	LZX414.00.10000
Installation kit with straight adapter	LZX414.00.20000
Junction box (for extension cables)	58670-00
Kit, screws and seals for sensor adapters	LZX417
L-bracket	ATS011
Miscellaneous hardware for probe installation kit	LZX416
Second fastening point, includes: bracket, sensor pipe stand, sensor pipe stand bracket, screws, and grommet)	LZX456
Sensor adapter, straight 1½-FNPT	AHA033NPT
Sensor adapter, elbow 1½-FNPT	AHA034NPT
Sensor fixed-point mounting kit: Sensor pipe bracket	ATS010
Sensor pipe stand bracket	LZX200
Set of wipers (for 5 changes) made of silicone for normal applications	LZX050
Set wipers (for 5 changes) made of Viton for e. g. media containing oil	LZX578
SOLITAX sc Instrument Manual	DOC023.54.03232
StablCal®, 800 NTU, 500 mL bottle (2 bottles required for calibration or calibration verification)	26605-49
Welded flange made of C-steel for the pipe installation fitting	LZX703
Welded flange made of stainless steel for pipe installation safety fitting	LZX660

Section 9 How to Order

U.S.A. Customers

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By Fax:

(970) 669-2932

By Mail:

Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.
Ordering information by e-mail: orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send an e-mail to: intl@hach.com or contact:

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; Fax: (970) 669-2932

Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call 1-800-227-4224 or e-mail techhelp@hach.com

Section 10 Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:

Hach Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
FAX: (515) 232-3835

In Canada:

Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

**In Latin America, the Caribbean, the Far East,
Indian Subcontinent, Africa, Europe, or the Middle East:**

Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Section 11 Limited Warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

Section 12 Certification

Hach Co. certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The **Model sc100/sc1000 with the Solitax Sensor** has been tested and is certified as indicated to the following instrumentation standards:

Product Safety

UL 61010A-1 (ETL Listing # 65454)

CSA C22.2 No. 1010.1 (ETLc Certification # 65454)

Certified by Hach Co. to EN 61010-1 Amds. 1 & 2 (IEC1010-1) per 73/23/EEC, supporting test records by Intertek Testing Services.

Immunity

This equipment was tested for Industrial level EMC per:

EN 61326 (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) **per 89/336/EEC EMC**: Supporting test records by Hach Company, certified compliance by Hach Company.

Standards include:

IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electro-Static Discharge Immunity (Criteria B)

IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electro-Magnetic Field Immunity (Criteria A)

IEC 1000-4-4:1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)

IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)

IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)

IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

Additional Immunity Standard/s include:

ENV 50204:1996 Radiated Electro-Magnetic Field from Digital Telephones (Criteria A)

Emissions

This equipment was tested for Radio Frequency Emissions as follows:

Per 89/336/EEC EMC: **EN 61326:1998** (Electrical Equipment for measurement, control and laboratory use-EMC requirements) Class "A" emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment

EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

Additional Emissions Standard/s include:

EN 55011 (CISPR 11), Class "A" emission limits

Canadian Interference-causing Equipment Regulation, IECS-003, Class A

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

FCC PART 15, Class "A" Limits

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the Controller from its power source to verify that it is or is not the source of the interference.
2. If the Controller is connected into the same outlet as the device with which it is interfering, try another outlet.
3. Move the Controller away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

Appendix A Modbus Register Information

Table 5 Sensor Modbus Registers

Group Name	Tag Name	Register	Data Type#	Length	R/W	Description
Measurements	TurbidityFNU	40001	Float	2	R	Turbidity FNU
Measurements	TurbidityEBC	40003	Float	2	R	Turbidity EBC
Measurements	SolidsMGL	40005	Float	2	R	Solids mg/L
Measurements	SolidsGL	40007	Float	2	R	Solids g/L
Measurements	SolidsPR	40009	Float	2	R	Solids %
—	reserved	40011	Unsigned Integer	1	R	reserved
Base	Parameter	40012	Unsigned Integer	1	R/W	parameter
Base	UnitTRB	40013	Unsigned Integer	1	R/W	Unit Turbidity
Base	UnitTS	40014	Unsigned Integer	1	R/W	Units Solids
Calibration	OffsetTRB	40015	Float	2	R/W	Turbidity Offset
Calibration	FactorTRB	40017	Float	2	R/W	Turbidity Factor
Calibration	FactorTS	40019	Float	2	R/W	Solids Factor
Data	wiperstate	40021	Unsigned Integer	1	R/W	wiper register
Setup	ResponseInterval	40022	Unsigned Integer	1	R/W	response time
Setup	CleaningInterval	40023	Unsigned Integer	1	R/W	wiper interval
Setup	LogInterval	40024	Unsigned Integer	1	R/W	Logger interval
Setup	Outputmodekal	40025	Unsigned Integer	1	R/W	Output when calibrate
Setup	Outputmodesrv	40026	Unsigned Integer	1	R/W	Output when service
Setup	Location	40027	String	8	R/W	Edited name
Setup	ProfilCounter	40035	Unsigned Integer	1	R/W	Profi counter
Data	SerienNummer	40036	String	6	R	serial number
Calibration	DateUserCal	40042	Date	2	R	date of manufacturing calibration
Calibration	DateUserCalTURB	40044	Date	2	R	date of calibration turbidity
Calibration	DateUserCalSOLID	40046	Date	2	R	date of calibration solid
Data	VersionAppl	40048	Float	2	R	Version application
Data	VersionBoot	40050	Float	2	R	Version Bootlader
Data	VersionStruct	40052	Unsigned Integer	1	R	Version structure probedriver
Data	VersionContent	40053	Unsigned Integer	1	R	Version register probedriver
Data	VersionFirmware	40054	Unsigned Integer	1	R	Version firmware probedriver
Data	FormatMinFNU	40055	Float	2	R	minimum turbidity FNU
Data	FormatMaxFNU	40057	Float	2	R	maximum turbidity FNU
Data	FormatMinEBC	40059	Float	2	R	minimum turbidity EBC
Data	FormatMaxEBC	40061	Float	2	R	maximum turbidity EBC
Data	FormatMinGL	40063	Float	2	R	minimum solids g/L
Data	FormatMaxGL	40065	Float	2	R	maximum solids g/L
Data	FormatMinMGL	40067	Float	2	R	minimum solids mg/L
Data	FormatMaxMGL	40069	Float	2	R	maximum mg/L
Data	FormatMinPR	40071	Float	2	R	minimum solids %
Data	FormatMaxPR	40073	Float	2	R	maximum solids %
Data	SignalsLED	40075	Unsigned Integer	1	R	Signal LED
Data	SignalsMoist	40076	Unsigned Integer	1	R	Signal moist

